MACHINE BODY HAVING AN UPPER BODY CAPABLE OF BEING POSITIONED AT ANY ANGLE

DESCRIPTION

Background of Invention

[Para 1] 1. Field of the Invention

[Para 2] The present invention relates to a machine body, and more particularly, to a machine body having an upper body capable of being positioned at any angle.

[Para 3] 2. Description of the Prior Art

[Para 4] Image processing devices such as scanners and multi-function peripherals (MFP) are applied widely nowadays. Most of the machine bodies have an upper part and a lower part. The upper part is a heavy body connected to the housing of the machine body, and is capable of being lifted up. The upper body often utilizes a restoring force of a connected spring when it is positioned at an angle within a limited range. Please refer to Fig. 1. Fig. 1 is a perspective diagram of a prior art multi-function peripheral 100. 110 is a housing. 120 is an upper body. 130 is a hinge connected to the upper body 120 and the housing 110. The hinge 130 includes two springs 132 and 134. The upper body 120 is connected to the housing 110 through the hinge 130. The weight of the upper body 120 generates a moment at the joint of the upper body 120 and the housing 110. The moment increases while the angle between the upper body 120 and the housing 110 decreases. A restoring force is generated when the springs 132 and 134 are compressed, and the restoring force forms moments along different directions to the joint of the upper body 120 and the housing 110. If the moments provided by the hinge 130 are comparable to the moment generated by the weight of the upper body 120

when the upper body 120 is positioned at an angle A1 (not marked in Fig. 1), the upper body 120 stays positioned at the angle A1. However, when the angle between the upper body 120 and the housing 110 decreases, the moments that the hinge 130 provides will gradually not be able to balance the moment formed by the weight of the upper body 120. Please refer to Fig. 2. Fig. 2 is a perspective diagram of the prior art multi-function peripheral 100 illustrated in Fig. 1 when the upper body 120 is positioned at a small angle. When closing the upper body 120, the upper body 120 swings toward the housing 110 quickly according to gravity. This is because when the angle between the upper body 120 and the housing 110 is as small as illustrated in Fig. 2, the moment at the joint of the upper body 120 and the housing 110 increases and exceeds the moments that the hinge 130 provides. Therefore, the upper body 120 is not able to be positioned at that angle but keeps falling to land on the housing 110 heavily. To avoid this, the user needs to support the upper body 120 and manually close it smoothly, or the supporting springs 132 and 134 need to provide a larger moment such that the momentum of the upper body 120 can be reduced. However, the upper body 120 will tend to spring open when lifted up if the restoring force of the springs is too large. In this case, the upper body can no more be positioned at angles other than the maximum angle, and the excessive upward bounce brings an excessive stress to the springs 132 and 134 and their bases. The related elements are easily damaged according to the stress. In the prior art, the springs included in the hinge connecting the upper body and the housing may also be designed for being compressed when the upper body is closed downward, and the upper body is fixed to the housing by a hook to overcome the restoring force of the springs. When unfastening the hook, the restoring force of the springs forces the upper body upward. The upper body in this design is not capable of being statically positioned at angles other than fully open and closed.

[Para 5] The upper body only capable of being positioned at specific angles, the user needing to support the upper body manually when the upper body is closing, and a closing hook being necessary are some of the main

flaws in the prior art. Furthermore, the restoring force of the springs utilized to support the upper body brings excessive stress to the springs and their bases. Therefore, the design of the hinge connecting the upper body and the housing is often very complicated. The cost of this kind of machine body is accordingly high.

Summary of Invention

[Para 6] It is therefore a primary objective of the claimed invention to provide a machine body having an upper body capable of being positioned at any angle.

[Para 7] Briefly described, the claimed invention discloses a machine body having an upper body capable of being positioned at any angle. The machine body includes a housing, an upper body capable of being positioned at a range of angles relative to the housing, and a hinge. The hinge includes a support shaft connected to the upper body, and a support block connected to the housing, the support block comprising a hole, and the support shaft passing through the hole and capable of moving up and down through the hole.

[Para 8] It is an advantage of the claimed invention that the upper body of the machine body is capable of being positioned at any angle. In the claimed invention, the support shaft tightly fits the support block, hence the hinge can provide a stable supporting force no matter at what angle the upper body is positioned.

[Para 9] These and other objectives of the present invention will no doubt become obvious to those of ordinary skill in the art after reading the following

detailed description of the preferred embodiments that are illustrated in the various figures and drawings.

Brief Description of Drawings

[Para 10] Fig. 1 is a perspective diagram of a prior art multi-function peripheral.

[Para 11] Fig. 2 is a perspective diagram of the prior art multi-function peripheral when the upper body is positioned at a small angle.

[Para 12] Fig. 3 is a perspective diagram of the present invention machine body.

[Para 13] Fig. 4 is a sectional perspective diagram of the present invention machine body.

[Para 14] Fig. 5 is a sectional diagram of a first embodiment of the present invention machine body when the upper body is closed.

[Para 15] Fig. 6 is a sectional diagram of a first embodiment of the present invention machine body when the upper body is open.

[Para 16] Fig. 7 is a sectional diagram of a second embodiment of the present invention machine body when the upper body is open.

[Para 17] Fig. 8 is a sectional diagram of an embodiment of the present invention hinge.

Detailed Description

[Para 18] Please refer to Fig. 3. Fig. 3 is a perspective diagram of the present invention machine body. 300 is a machine body of the present invention. 310 is a housing. 320 is an upper body. 340 is a joint axle connected to the upper body 320 and the housing 310. 336 is a rotation axle. Please refer to Fig. 4. Fig. 4 is a sectional perspective diagram of the machine

body 300 illustrated in Fig. 3 along a section line 4-4'. 330 is a hinge and includes a support block 334 and a support shaft 332. The support block 334 comprises a hole 390, and the support shaft 332 passes through the hole 390 and is capable of moving up and down along the hole 390. The support shaft 332 connects to the upper body 320 and tightly fits to the support block 334 through the hole 390. Please refer to Fig. 5. Fig. 5 is a sectional diagram of the present invention machine body 300 when the upper body 320 is closed. Please further refer to Fig. 6. Fig. 6 is a sectional diagram of the present invention machine body 300 when the upper body 320 is open. As illustrated in Fig. 6, when the upper body 320 is lifted up, the support shaft 332 is raised up accordingly since the support shaft 332 is connected with the upper body 320, the support block 334 rotates around the rotation axle 336 in consequence since the support block 334 tightly fits the support shaft 332, and the support shaft 332 remains in the hole 390 of the support block 334. As the support shaft 332 remains tightly fit to the support block 334, the supporting force provided by the hinge 330, that is, the supporting force from the tight fit between the support shaft 332 and the support block 334 is identical, no matter at what angle the upper body 320 is positioned. Therefore, as long as the moment to the joint axle 340 generated by the supporting force provided by the hinge 330 is able to overcome the moment to the joint axle 340 generated by the weight of the upper body 320, the upper body 320 included in the machine body 300 is capable of being statically positioned at any angle.

[Para 19] As illustrated in Fig. 5 and Fig. 6, the hole 390 comprised in the support block 334 is a cylindrical hole, and the support shaft 332 is a corresponding cylinder tightly fitting to the support block 334 through the hole 390. Since the hole 390 comprised in the support block 334 and the support shaft 332 are cylindrical, the support block 334 has to be rotatably connected with the housing 310. Therefore, when the support shaft 332 is raised along with the lifting of the upper body 320, the support block 334 consequently rotates around the rotation axle 336. In consequence, the

support shaft 332 is capable of remaining tightly fitting the support block 334 at a lower section as illustrated in Fig. 6. No matter what section of the support shaft 332 fits the support block 334 tightly, the moment and the damping provided by the tight fit are fixed as long as the tightness of the fit and the length of the section of the shaft that fits the support block are constant.

[Para 20] Besides the hinge that comprises a straight cylindrical support shaft and a support block with a corresponding straight cylindrical hole, the present invention can also utilize a hinge that comprises a curved cylindrical support shaft and a support block with a corresponding curved cylindrical hole. Please refer to Fig. 7. Fig. 7 is a sectional diagram of a second embodiment of the present invention machine body when the upper body is open. 500 is a machine body including a housing 510, an upper body 520 and a hinge 530. The upper body 520 connects to the housing 510 through a joint axle 540. The hinge 530 comprises a support block 534 and a support shaft 532, wherein a hole 590 corresponding to the support shaft 532 is included in the support block 534. The support shaft 532 is connected with the upper body 520. The support shaft 532 passes through the hole 590 and tightly fits to the support block 534. Compared to the hinge 330 illustrated in Fig. 5, in the hinge 530, the hole 590 is a curved hole corresponding to the arc along which the upper body 520 is lifted up, and the support shaft 532 is a curved shaft corresponding to the curved cylindrical hole 590. Therefore, the support block 534 can be fixed to the housing 510, and the support shaft 532 can still move up and down along the hole 590 along with the lifting and lowering of the upper body 520, and can provide a stable supporting force and moment to the upper body 520.

[Para 21] Please refer to Fig. 8. Fig. 8 is a sectional diagram of an embodiment of the present invention hinge. 630 is a hinge of the machine body. 632 is a support shaft. The hatched area is a support block 634. The

support shaft 632 is cylindrical and the area of the cross section of a section of the support shaft 632 is smaller than the rest of the support shaft 632. The section of smaller area does not tightly fit but loosely fits the support block 634. For the machine bodies illustrated in Fig. 5, Fig. 6 and Fig.7, no matter at what angle the upper body is positioned, the section of the support shaft that passes through the hole of the support block tightly fits the support block. The supporting force and the moment provided by the support shaft 332 and the support block 334 are identical accordingly, so the upper body 320 is capable of being positioned at any angle from fully open to fully shut. However, the support shaft of the present invention can also have a section of which the area of the cross section is smaller, such as the support shaft 632 illustrated in Fig. 8. There are various applications for this. For example, when the upper body is positioned at a small angle, A2, it is often the case that the upper body is going to be lifted up continuously or be moved down continuously since it is useless for it to remain open at such a small angle, A2. The positions of the support shaft and the support block at this moment is just like those shown in Fig. 8. The upper section of the support shaft 632 has a smaller area of its cross section, and the upper section fits the support block 634 loosely. Therefore, a force weaker than the force generated by a section that completely tightly fits the shaft block is provided, so that the upper body cannot be positioned at the angle A2. However, there is still a friction force between the support block 634 and the support shaft 632, so a moment and a supporting force that help the upper body to lower smoothly still exist.

[Para 22] In summary, the aforementioned hinges are utilized in the present invention to make the upper body of the machine body, such as a multi-function peripheral or a scanner, capable of being statically positioned at any angle and being lifted up and closed smoothly. The machine body utilizes a force and a moment provided by a tight fit between a support block and a corresponding support shaft to support the upper body. The area of the cross section of the present support shaft may be varied to adjust the supporting force and moment. The housing, the upper body and their joint do

not receive stress as in the conventional machine bodies. For tightly fitting the support shaft, the material of the support block may be chosen from abrasion resisting materials, such as polyurethane rubber (PU rubber). The hinge of the present machine body may comprise one or a plurality of support shafts and a support block, wherein the support block comprises one or a plurality of corresponding holes, or the hinge may comprise a plurality of support blocks for fitting the plurality of support shafts. Thus, the present invention provides a machine body having an upper body capable of being statically positioned at any angle. The structure of the hinge of the machine body is simple and not susceptible to damage, and the cost is low. The flaws of the prior art, namely that the upper body cannot be positioned at angles beyond a limited range and the high stress received by the joint of the housing and the upper body, are solved.

[Para 23] Those skilled in the art will readily observe that numerous modifications and alterations of the device may be made while retaining the teachings of the invention. Accordingly, the above disclosure should be construed as limited only by the metes and bounds of the appended claims.